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INSTRUCTIONAL SYSTEMS DEVELOPMENT (ISD)
IN AIR FORCE FLYING TRAINING

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This is the final report of a study which identified and defined problems associated with the application of ISD technology to Air Force flying training programs. Data for the study were collected by a structured interview technique, and were categorized into 14 information categories. Analysis reduced the information to five problem identification/definition categories which are included as the main body of the report. Impact on ISD of each of the problems identified/defined is discussed.
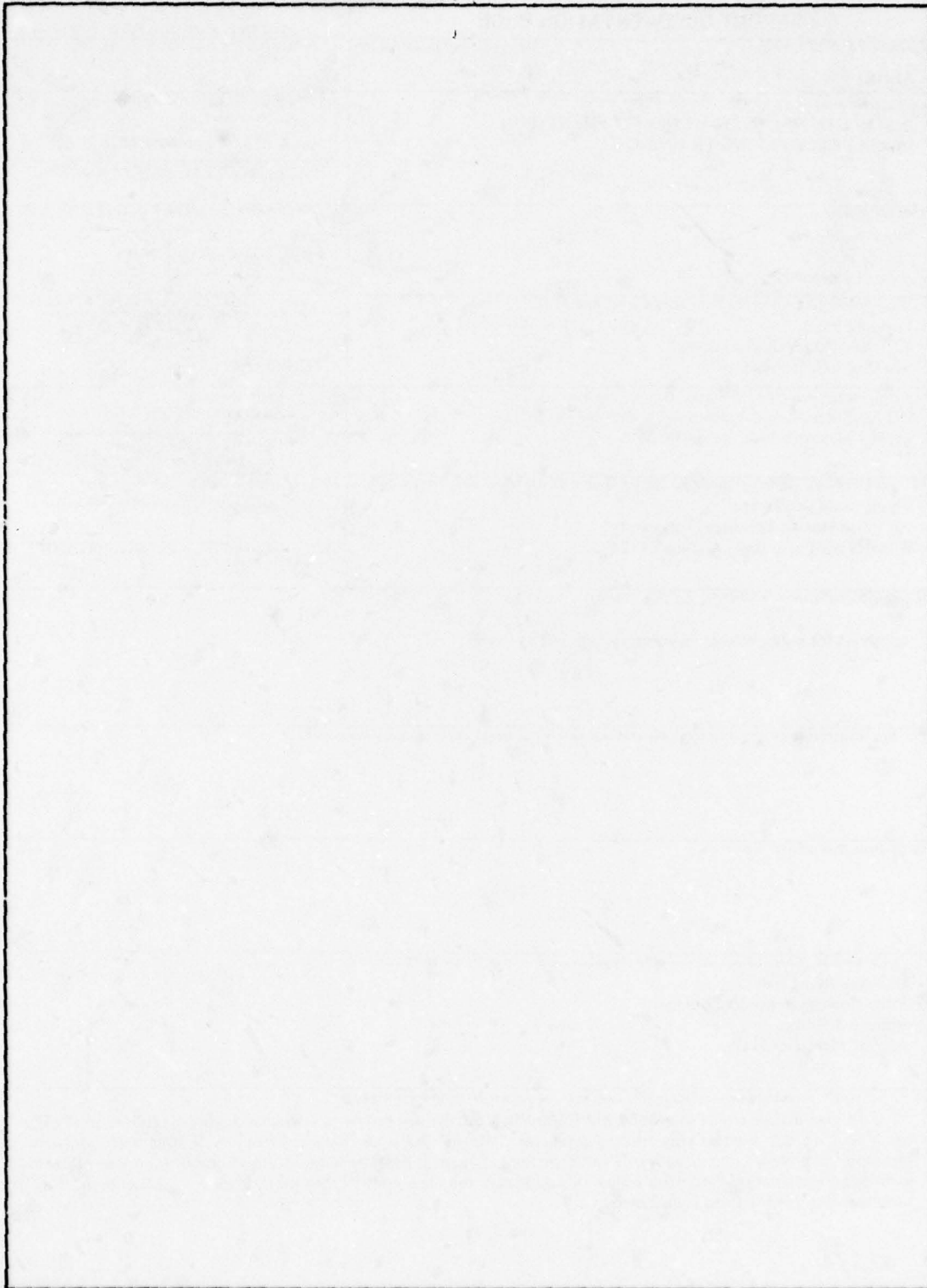
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## PREFACE

This report presents the results of the research being accomplished in support of Project 1123, Flying Training Development under the direction of James F. Smith.

The study was documented under Task 1123-02, Instructional Innovations in USAF Flying Training, Dr Bernell J. Edwards, Task Scientist, and Work Unit 1123-02-29, ISD Applications Study, Major James F. McKenzie, Jr., Contract Monitor. Dr Edward E. Eddowes assisted in task definition, editing and technical guidance.

The research reported herein was conducted under the provisions of contract F33615-77-C-0034 by Logicon Inc, of San Diego, California, Dr Jay R. Swink, Project Director, Mr Ralph Miller, Project Leader.

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## SECTION 1

## INTRODUCTION

1.1 PURPOSE. The primary purpose of this study is threefold:
(1) to identify and define problem areas in the application of Instructional Systems Development (ISD) methodology, (2) to describe common and uncommon problem areas in the application of ISD to flying training, and (3) to organize and analyze the problem descriptions into a structure which classifies the problems in terms of causes, effects, processes, personnel or cost attributes. The secondary purposes are to explore and similarly describe the relationship of Standardization/Evaluation (STAN/EVAL) with ISD and to explore and describe the adequacy of the ISD model explicated in AFM 50-2.

1.2 BACKGROUND. In 1970 the Air Force Chief of Staff required the application of the principles of ISD to all flying training programs. The application of these principles, and the subsequent establishment of ISD programs in place of conventional training, have been plagued with a variety of problems. These problems have resulted in a very slow pace in the development and establishment of training programs based on the principles of ISD. This slow pace has become a major Air Force concern. The effects of indefinitely prolonging the conversion process are not only expensive, they are undesirable from the perspective of training efficiency. Therefore, the Air Force has initiated a search for efficient means of improving the effectiveness of management and curriculum-development personnel who are engaged in ISD conversion processes. The present study is the first step in this research. The identification, description and preliminary analysis of the problems encountered in implementing ISD will provide the Air Force with a useful point of departure for their eventual solution.

Perspective. It must be noted that under the best of conditions ISD is lengthy and time-consuming because it is a formal and systematic process. A long series of interdependent tasks and subtasks must be accomplished, often in sequential order, with the output of earlier steps providing essential input for the later steps. The tasks and

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subtasks are complicated as the number and complexity of training requirements to be addressed increases. Therefore, though ISD did, indeed, suffer a slow start in the Air Force, it is very difficult at this time to estimate how long the process should take under ideal or normal conditions.

Present applications of ISD are pioneering efforts, none of which are yet completed through an entire revision/evaluation cycle. For this reason, empirical guidelines do not exist for ISD time requirements. Moreover, no theoretical guidelines have been presented in any of the documentation investigated in this and several other studies. The safest conclusion, therefore, is that the time requirements for a typical ISD conversion are, at best, an educated guess; at worst, unknown. Among the many factors with unknown time- and cost-effects are the number of dedicated ISD personnel available, the extent and quality of their experience, the support and funding available to the program itself, and finally, the amount and quality of cooperation from local training and training-support agencies.

Another time-impacting factor is the extent or depth to which the analytic steps of ISD are taken. Even programs with abundant personnel and support are discovering that a comprehensive task analysis for a multi-crew member aircraft with complex mission profiles can consume months, sometimes years, of effort. Such findings would indicate that a complete conversion of a "typical" Air Force training system will probably involve 3 to 5 years of effort without extraneous complications. With these complications, time requirements are even greater.

Thus, to a large degree the slow pace of ISD progress is inherent in the process itself. Certain tasks and subtasks, if well done, are simply time consuming. The remainder, that is the degree to which the slow progress is attributable to avoidable problems and complexities, is a genuine area of concern. These areas are the fundamental subject matter of this report.

It is important to recognize that in spite of slow progress and the problem areas discussed in this report, most of the ISD teams have accomplished a great deal, especially in recent years. Moreover, the prognosis for the future appears to be improving. ISD managers

are becoming increasingly skillful which results in fewer false starts and major direction changes to the programs as compared to those of 2 or 3 years ago. Analytic requirements are receiving more time and attention, on the average, and problems encountered are easier and less costly to correct. Finally, both the level of awareness and credibility of ISD principles are increasing throughout the Air Force, with the result that resistance to the ISD process is waning. Therefore, timely attention to the problems and concerns described in this report will provide a basis for greater efficiencies and progress in the provision of high quality flying training.

1.3 APPROACH. The identification and initial problem definition effort was accomplished by a series of on-site interviews of ISD personnel. Three Air Force command levels were represented: Air Staff, MAJCOM and Training/School squadron. The interview schedule and primary points of contact for each of these visits are described in the appendix of this report. Anonymity of interviewed personnel and location is preserved in the main body of the report. That it would be preserved was explained to the personnel involved at the time of the interview. This approach ensured that no repercussions would accrue to any statements made during the interview.

The description of common and uncommon problems in the application of ISD was accomplished in two efforts. The first reduced all relevant data obtained during the on-site interviews to 14 categories of information. These categories were essentially descriptive and contained very little analytic or interpretive commentary. They were initially submitted to the Contract Monitor in a data summary, dated October 15, 1977, and were submitted as a separate section of the interim technical report in accordance with CDRL requirements.

Organization and analysis of the problems involved reducing the data included in the 14 information categories into 5 major problem description categories, each of which treats up to half a dozen specific and well-defined problems. Each problem description includes: (1) a description of the situation surrounding and contributing to the problem, (2) a definition of the problem itself, and (3) a series of statements explicating the impact of each problem on the ISD process. In most cases, impact on one or more of the 5 steps of ISD as defined in AFM 50-2 was discussed. In the remainder of the cases, general impact on the ISD process as a whole was discussed. These problem descriptions are included in Section 3 of this report and constitute the main body of the report.

The relationship between ISD and STAN/EVAL was explored in two separate ways: (1) in the structured on-site interviews the impact of STAN/EVAL practices and procedures on ISD was discussed along with that of the other agencies associated with training, and (2) as a separate topic, first by specifically discussing the relationship with members of the ISD team and second, by conducting interviews with members of each of the local STAN/EVAL sections. Specific problems associated with the relationship, along with their impact on ISD, are discussed in section 3 of this report. A general overview of the relationship between STAN/EVAL and ISD is also discussed in the following subsection of this section.

Specific questions regarding the adequacy of the AFM 50-2 ISD model were asked at each of the interviews conducted. Problems and impact associated with the five-step model are discussed in section 3 as are the problems and impact associated with the use of AFP 50-58. A general overview of the uses and adequacy of this ISD model is provided later in this section.

Throughout the course of this study a number of practices related to the ISD effort were identified which appeared to be in very close accord with the philosophy of ISD, or appeared to be generally excellent training practices. These are summarized and discussed later in this section.

Finally, several of the problems identified in this study were singled out because of their severe impact on the ISD process and/or their need for immediate attention. These are discussed in the first subsection of section 3.

1.4 CHARACTERISTICS AND TREATMENT OF THE DATA. During the early portion of this study a work plan was defined which included a separate interview questionnaire for each of the command levels visited during the study. Each of the questionaires was designed to explore ISD variables, parameters and problems specific to its targeted command level. Copies of the questionaires were sent to key ISD points of contact prior to the contractor on-site visits to provide ISD personnel an opportunity to preview the specific questions and direction of the interview, and to amass relevant data.

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Early on during the actual data collection visits it was discovered that the questionnaires did not completely anticipate the wide variety of approaches taken to ISD within the major commands and training squadrons. The variety of approaches was taken in response to unique situations and constraints which were specific to virtually each of the data collection sites visited. In some cases, local resistance was instrumental in establishing the direction of ISD; in other cases, the remoteness of available graphics/production capabilities shifted the focus of the effort. In yet other cases, the availability of general training support resources and/or personnel greatly affected the range of approaches observed.

Primarily for these reasons the data collected were virtually descriptive in nature, as opposed to quantitative. No attempt was made to conduct comparative statistical analyses because any particular event or problem under discussion is most likely to be a member of a sample of limited size, usually one. Moreover, it is methodologically unsound to attempt quantitative or statistical comparisons between a command or squadron in which the ISD team is fully staffed with qualified personnel and adequate resources, and one which is understaffed with inexperienced personnel and limited resources.

Therefore, each of the problems discussed in this study is treated on an individual basis, although each is contained within one of five major problem areas which are reasonably mutually exclusive and internally consistent with regard to the basic characteristics of the problems contained. A discussion of high-priority problems also treats a group of problems individually and descriptively, but in a separate subsection of section 3, which is additional to the 5 major problem areas.

The problems and problem areas discussed in this report were distilled from a very large quantity of raw interview data. The approach taken was briefly described in subsection 1.3. It is noted here that the approach was derived after a thorough review and analysis of all of the data obtained in the study, and is itself based on the descriptive characteristics of the data. The first step was to identify all of the situations and problems pertinent to ISD and then to separate them from those which are extraneous. For example, problems which had been corrected by the time of the interview were not treated even though

their (diminishing) impact was still apparent. Among these were witnessed non-ISD task requirements imposed by since-departed authorities, methodological disagreements at higher command/ management levels, the development of instructional modules (particularly slide/tape) which were defective and/or not useful due to insufficient analysis (since corrected) and so forth.

With the next step came a search for common elements among the problems. This was done to find broad, but well-defined categories in which the problem data could be contained. As noted in subsection 1.3, 14 information categories were eventually defined. These categories contained information related to both the problems in ISD and the situations surrounding and/or contributing to the problems. At this level of analysis, however, the problems and situations were not separate; rather, they still comprised a conglomerate of problem-related data.

The ensuing step required the separation of the specific problems from the surrounding situations. Care was taken to provide a clear distinction between the two in order to provide a firm basis for any following problem-solving efforts. Rationale for this step is that very often an effort to treat a problem without regard for mitigating circumstances is analogous to medical treatment of an isolated symptom; it is not likely to work. Though in the realm of ISD such an analogy is tentative, it was decided that a clear exposition of both symptom and cause would provide the greatest likelihood of a solution.

Finally, the impact of the various situations and problems on the ISD process was described. The primary reason for this step was to provide the Air Force with a basis for ordering the problems according to a priority scheme, the priority depending on the magnitude or cost of the impact. Section 3 discusses these problems in an order which is roughly based on their priority within the major problem areas. A cautionary note, however, is that this ordering is based on contractor perspective, and might not correspond perfectly with an Air Force ordering which has the advantage of personnel, support and cost figures as well as knowledge of future plans and resources. Agreement on priority aside, the approach and treatment of the data just described are intended to contribute to significant and observable progress in the implementation of ISD.

## SECTION 2

## EXEMPLARY PRACTICES AND PROCEDURES

Since the primary purpose of this study is the identification and description of problems associated with ISD implementation/conversion efforts, the tenor of the report is critical. In order to offset the impression that all practices and procedures observed are to the detriment of ISD the following observations are included. They are examples of current practices which are in close accord with the philosophy of ISD or are good training practices in general.

a.  In several instances, genuine efforts to sytematically implement all the steps of ISD were observed. Such efforts are distinguished from the common practice of attempting to shortcut certain steps, in particular, those of the task analysis. Though the systematic implementation of all of the steps of ISD is time consuming, the benefits are obvious. For example, such an approach is balanced, and precludes over-emphasizing certain aspects of ISD to the exclusion of others, as is the case when media production/development processes absorb disproportionate amounts of time and resources. Another benefit is that the systematic approach precludes short cutting the analytic steps which, if adequately done, provide the foundation for the entire instructional curriculum.

b.  Efforts to involve and educate all local training agencies in ISD promise to reduce later problems in the total integration of training. ISD tasks and subtasks are often introduced with little preparation or indoctrination which, in turn, appears to increase both internal and external resistance to ISD. Throughout the course of this study it was empirically verified that the better Air Force personnel understand the principles of ISD, the less they tend to resist its implementation. Several STAN/ EVAL personnel were interviewed who are actively promoting ISD based on their present knowledge, whereas in the past they professed to be either unconcerned or negatively disposed toward the process.

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c.  Some ISD teams provide management support and guidance to cooperating local training agencies. This practice greatly reduces initial project confusion and helps to eliminate false starts on tasks and subtasks. It also helps to eliminate the general lack of management expertise throughout ISD. (Refer to section 3, this report.) Finally, it aids the general dispersal of ISD knowledge and understanding throughout the Air Force, which, as noted in the preceding paragraph, aids in reducing resistance at all levels.

d.  The derivation of flexible formats for the accomplishment of individual steps, tasks and subtasks has allowed significant progress to be made in the presence of local resistance to ISD. The resulting progress often helps to overcome this resistance, as well. Flexibility also provides the opportunity to derive unique approaches to tasks and subtasks which are subject to local anomalies and constraints. These approaches also can contribute to the general body of knowledge about ISD.

e.  In one case, a project outline was derived from the learning objectives. Tracking the course of these objectives through the steps of ISD allowed for use of the outline as a management tool. This unique approach is both logical and systematic insofar as it deals with the basic elements of the curriculum as well as (ideally) all of the steps, tasks and subtasks of ISD. One immediate benefit of such an approach is that a limited subset of objectives can be selected and used for either ISD training or demonstration purposes. Such an algorithm would be particularly useful for demonstrating media selection techniques, evaluation techniques and subsequent revision processes, in addition to the management function it presently serves.

f.  The validation of ISD products on representative samples of the user population is often omitted in the interests of hastily providing these products to the various training sections. A number of ISD teams resist this practice and make every effort to validate all instruction before it is incorporated into the curriculum. Validation of instruction is extremely important to the student primarily because it ensures that what he is learning is appropriate to his eventual operational

responsibilities. The presentation of non-validated instruction could, in the worst case, result in poorly-trained, unsafe students at the graduation level. This, in turn, would necessitate greater amounts of continuation training, a reduction in the graduated students' operational responsibilities, or both.

g. Efforts toward the development of a curriculum based strictly on need-to-know items were identified in this study. Such a goal is by no means easily attainable. In some squadrons virtually every nonessential item removed from the curriculum elicits dialectic combat among local agencies with differing interests. In addition, some items are removed only to be reinserted later by other training personnel. Failure to implement the need-to-know filter ultimately prevents the development of a time-effective curriculum which, in turn, reduces the chances for cost-effective training.

h. At least one ISD team has initiated procedures for pre-testing entry level students, not only for establishing basic proficiencies but to avoid redundancies in future training as well. The latter goal is rare and reflects extremely good ISD practice which accords with the need-to-know philosophy. Taken in conjunction with established graduation-level proficiencies, these pre-tests provide a means of sizing the instructional curriculum to the exact training needs of the students.

i. Attempts are currently in progress to augment task analytic data with data from field operations. This practice will eventually allow for the construction of a curriculum which is realistically geared to the appropriate terminal level proficiency. It also provides continuity between squadron training and field operations and/or continuation training. Finally, it promotes a better understanding of ISD in the field, a factor which usually promotes greater support for ISD Air Force-wide.

j. Follow-up studies which verify the effectiveness of the curriculum employ interviews of graduating students. These studies will eventually provide information which is essential to the ISD revision. They are also an essential element of the instructional validation process.

k.  ISD philosophy is disseminated locally by allowing ISD teams the opportunity to teach instructional cadre. This practice also provides the instructors with an easier transition between pre-ISD and ISD instructional responsibilities. It also provides a better understanding of ISD support responsibilities, as well as a greater probability of obtaining the support.

l.  Some team members have begun to resist the tendency for premature selection of media and the unselective mediation of instructional material. The effort is made to provide a thorough analysis of media requirements which are, in turn, based on the behavioral characteristics of the learning objectives. Premature selection of media has often resulted from higher command pressure to produce some tangible product of ISD, as an indirect result of the extensive time requirements of the analytic steps. It can easily result in the development of a curriculum which is qualitatively similar to the pre-ISD curriculum, except for its manner of presentation. Avoiding such an approach by first accomplishing the required analyses allows for a balanced curriculum which is based on actual, analytically-derived learning requirements.

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# SECTION 3

## PROBLEMS AND PROBLEM AREAS

3.1 <u>RELATIONSHIP BETWEEN ISD AND STAN/EVAL.</u> Historically, STAN/EVAL and ISD have borne something of an adversary relationship to one another. However, the adversity is not presently uniform, and probably never was. Existing relationships at the training squadron level range from hard-core resistance to ISD, on the part of STAN/EVAL, to willing and useful cooperation. In some cases the cooperation extends beyond sharing the burden for the implementation of ISD to include its active promotion.

As discussed later in this section, STAN/EVAL's resistance to ISD has stemmed from two sources. The first is the chaotic and confusing efforts to implement ISD on the part of the ISD teams. Such resistance is particularly strong in cases where audiovisual media and materials are being proliferated and STAN/EVAL is exposed to little else in the way of ISD. The second source is a strongly held belief on the part of some STAN/EVAL personnel that complex higher level flying skills can neither be quantified nor objectified. These personnel tend to resist the implementation of objectives and tests derived by the ISD teams. They also tend to use subjective, highly personalized grading standards for proficiency-level checkrides which, in turn, result in discontinuities between training and testing phases for the student.

Although resistance still exists, STAN/EVAL sections and ISD teams demonstrate increasing tendencies for fruitful cooperation. This is partially due to the dissemination of information about ISD throughout the Air Force. As the process is better understood, resistance tends to diminish on the part of STAN/EVAL as well as on the part of other training agencies. Probably the last issue to be resolved, however, will be that of the subjective grading standards. In several STAN/EVAL sections interviewed, initial resistance had converted to broad-scale cooperation with ISD with the invariable exception being the retention of subjective grading standards for the final checkride. These, too,

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will no doubt yield as the general understanding of ISD continues to spread throughout the Air Force and as the quality of the training produced by ISD continues to improve.

3.2 ISD MODEL. As will be noted later in this section, approximately half of the ISD teams interviewed reported using the 5-step model described in AFM 50-2. A slightly lesser number reported a preference for the guidelines and direction provided by AFP 50-58. A very few teams used neither of these sources, relying more or less exclusively on guidelines provided by the ISD squadrons, the Mager schools, the ATC ISD school, the ATC ISD advisory service, etc. At least one command has established liaison with U.S. Army ISD personnel; others have explored the utility of the Interservice Procedures for Instructional Systems Development (IPISD), or ITRO model.

None of these preferences or practices represents a radical departure from the use of the model delineated in AFM 50-2. The fact is that the majority of ISD teams are currently using either AFM 50-2 as the primary source document, or using its supplement, AFP 50-58. These two documents delineate essentially the same model. The Mager schools themselves represent more of an expansion and clarification of specific ISD tasks and subtasks than they do departures from the model, even though they occasionally tend to cover new ground (goal analysis as separate and distinct from task analysis). Finally, personnel who have explored the IPISD model report that its content is encompassed by AFM 50-2 and vice-versa, although flow-charting techniques in the former were judged to be useful.

Thus, the currently accepted Air Force ISD model does not differ from that delineated in AFM 50-2 and expanded/clarified in AFP 50-58. Historically, frequently expressed criticisms of AFM 50-2 were that: (1) it does not address the issue of responsibility, that is, exactly who is responsible for implementing ISD? (The directive that ISD must be accomplished is a different issue), (2) it is self-contradictory in places, and, in places is contradictory with other related ISD documents such as AFP 50-58, and (3) certain detail-level tasks and subtasks associated with the implementation of ISD are not sufficiently explained to allow the tasks to be accomplished. Correlated with this latter point is the suspicion that some of these tasks are not actually subject to a formal, systematic approach but rather, require the use of "best-guess" or intuitive measures.

The first of these criticisms cannot be held against the model itself, since the issue of responsibility is external to either utility or formal consistency. Moreover, AFR 50-8, which currently supplements and provides additional direction to AFM 50-2, has both recognized and dealt with the criticism.

The second of these criticisms, that the documentation associated with the model is contradictory (i. e., not consistent), might indeed reflect upon the model. Two separate issues can be addressed in this regard First, the model is (internally) consistent if direction or guidance specified in any one step or task is not contradicted by that found in any other step or task. Second, consistency is also demonstrated in the case that related documents do not contradict one another. Consistency of the model is not at issue in the case that one model contradicts another, or that unrelated documents contradict one another.

In any event, demonstrated contradictions among the steps of the model, among associated tasks/subtasks and/or among AFM 50-2, AFP 50-58 and AFR 50-8 would, for present purposes, point to inadequacies in the "official" Air Force ISD model. Such contradictions have, indeed, been reported, notably between the manual, 50-2 and the pamphlet, 50-58. Contradictions have also been reported within AFM 50-2, which casts suspicion upon the consistency of the 5 steps and their tasks and subtasks.

The thorough investigation of all reported contradictions in the ISD model would constitute a study in and of itself, and was consequently beyond the scope of the present study. Those for which available time allowed investigation often reduced to omissions and misunder-standings as opposed to contradictions. (For example, the process of translating task data into learning objectives, teaching points and proficiency tests is not described comprehensively enough that it may be systematically accomplished without reference to subjective and/or trial-and-error techniques. Similarly, the translation of task/learning data into media selection and development algorithms also requires an element of subjective judgement which is not described in existing manuals. ) Moreover, a completely fail-safe test of the consistency of the ISD model would require a complete iteration of the entire ISD process, including revision, according to the formal methodology described in the source documents. In the absence of such a test, judgement is withheld regarding the issue of consistency in the formal sense. It is noted, however, that all serious claims of inconsistency

can be investigated by observation as the various ISD teams progress in their conversion of flying training. If these claims reduce to simple omissions and lack of clarity and detail in the documentation (as present evidence indicates) the issue becomes one of refining and detailing the model as opposed to rejecting it.

Unfortunately, until recently the tendency has been to infer that the model is indeed contradictory or inadequate. For example, it is often claimed that complex, higher-level flying skills are neither objectifiable nor quantifiable. Thus, by inference, ISD is not adequate to the task of training these skills. Moreover, the lack of official guidelines for the management of ISD is a substantiated omission in the source documents. Yet, in fairness to the model, little effort has been made to extend ISD techniques (e. g., task analysis) into the higher skill areas while the omission of technical management detail is neither fatal nor impossible to correct. This latter point is illustrated by the fact that most ISD teams have begun to generate their own in-house supplementation of the existing documentation. These supplemental materials are based on experience and take the form of worksheets, workbooks, standardized forms for task analysis, forms for development and production of mediated materials, etc. It would appear that their incorporation into official ISD documentation will eventually provide all of the "missing" detail for the systematic accomplishment of ISD.

3.3 HIGH PRIORITY PROBLEMS. The following problems are noted in this section for one or both of two reasons: (1) the problem has a severe detrimental impact upon ISD, is both costly and time-consuming, and should be resolved as soon as possible; and/or (2) the solution to the problem would result in immediate positive impact upon ISD, and would reduce both cost and time investments.

3.3.1 Insufficient Task Analysis. Problems and inadequacies of "front-end analysis" are universally discussed issues. They cover a spectrum which ranges from shortcut/bypass techniques to methodological/procedural deficiencies in ISD manuals, pamphlets, and regulations. AFR 50-8 contributes to these problems because of the variable ways of interpreting the levels of analysis it allows. In addition, current manuals and pamphlets do not provide enough detail to carry out all the analytic tasks without reference to outside sources or to

intuitive, best-guess techniques. Both definitional and translational difficulties predictably arise whenever a full-scale analysis is engaged. For example, universally acceptable definitions of functions, tasks, subtasks, microtasks, etc., do not presently exist; nor do universally implementable algorithms for translating task data into objectives, conditions, and standards exist. Finally, the need-to-know filter applied to existing task data is more a matter of training community consensus than it is a formal, analytic technique.

One way of supplementing these analytic deficiencies, is the flow-charting technique for task analysis. This is a Mager technique which is demonstrated in the various Mager schools, and which is gaining increasing success and popularity. A similar technique involves the use of operational sequence diagrams, which are time-based symbolic representations of each of the information/decision/ action patterns taken by the operator, in this case, the ISD curriculum developer. As these and other techniques are developed and success-fully used they may be disseminated throughout Air Force ISD with the promise of significantly improving the quality and efficiency of analysis.

3.3.2 <u>Premature Commitment to Media</u>. Mediation processes are enormously time consuming. They typically absorb all available ISD time and effort to the degree that outside observers begin to equate ISD with media. Progress in other ISD tasks often comes to a halt as media production begins to absorb more and more time and resources. Premature mediation efforts coexist with, and contribute to, the ten-dency to shortcut or bypass critical analytic steps, and stem partially from the fact that mediation techniques are trained and given great emphasis in the existing ISD schools. Premature mediation also shifts attention away from validation and evaluation processes. Moreover, the sizeable costs associated with both the media (videotape, slide/ tape, etc.) and the production of material results in an understandable reluctance to either reduce the scope of the mediation effort or simply accept the losses attached to abandoning unacceptable media or material. Thus, given very sizeable expenditures, the media begin to drive the approach and direction of ISD in much the same manner that the avail-ability of airplanes tends to drive training schedules. This constitutes the most significant single problem associated with a fixation on media. Methodologically, mediation processes in and of themselves provide

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no underlying basis for the structure and direction of the instructional system. Rather, this is the proper role of analysis, which, when completed, provides all the basic data from which instruction is derived. From these data, which are ultimately explicated in behavioral form, the media requirements are derived. These should be based on the characteristics of the analytic data, not, as is often the case, on availability or preference. Granting due consideration to the fact that a great deal of effort has already been spent, that many learning centers are in place, and that media equipment is currently operating the common tendency to over-emphasize media needs immediate attention. One training squadron has recently recognized the shortcomings of this tendency, and has shifted the effort back to analysis, with difficulty, and is attempting to recover the systematic aspect of ISD. Others, upon encountering methodological difficulties for which mediation has no answer, may have to take the same approach.

3.3.3 <u>Management Deficiencies</u>. The general absence of management expertise appropriate to ISD is discussed more fully later in this section. It is pointed out here that virtually every problem which arises during ISD conversion is in some way attributable to management. Presently, the lack of ISD management skills is being felt with increasing severity at all Air Force levels associated with training. Given the scope, cost, and time requirements of the typical ISD conversion effort, its proper management should be immediately addressed, particularly at middle-management levels and above.

With regard to the overall conduct of ISD, the greatest deficiencies appear at the point of estimating and planning broad-scale tasks and subtasks. For instance, the analytic tasks routinely exceed their initial time allocations, as do mediation and general revision efforts. Resulting schedule slippages require devising and falling back on alternative plans on a more or less continuous basis. Secondary impact accrues to personnel allocation practices, resource allocations, and support requirements.

Fortunately, ISD has now been in progress for several years, with the advantage that a large pool of knowledgeable personnel presently exists. Under reasonably supportive circumstances these personnel could form a nucleus of management expertise to augment that of existing management training schools which are beginning to emerge within some of the major commands. Whatever approach is taken, the issue of ISD

management should be addressed as soon as possible. The consequences of delay lie primarily in the loss of the existing pool of knowledgeable personnel, through retirement and transfer to other duty assignments.

3.3.4 <u>Terminal Level Proficiencies and Grading Standards</u>. Proficiency levels and grading standards are frequently cited problem sources. Probably they are the central issues in cases of STAN/EVAL resistance to ISD. Exploration of the causes of resistance invariably leads to some form of disagreement between ISD and STAN/EVAL regarding grading and proficiency checking in general. In fact, the disagreement often hinges specifically upon terminal level proficiency standards, what they should be, and how they should be tested. A number of related issues are discussed in the following subsection of this report. One key issue is discussed in the following paragraphs.

STAN/EVAL is often extremely reluctant to yield a certain measure of subjectivity in their grading practices. Even in cases of willing support and cooperation in other areas of ISD, the issue of the final checkride grade for the student is apt to remain unresolved. At the same time, it is poor investigative technique to simply conclude that STAN/EVAL sections resist for the sake of resisting, especially in view of their backgrounds and experience levels. The search for causes underlying this resistance eventually led to the general issue of operational squadron requirements and indirectly, the related issue of continuation training.

STAN/EVAL personnel are acutely aware of operational requirements which face the student upon graduation from squadron level training. They are also aware of the gap which frequently exists between students' graduation level proficiencies and operational squadron expectancies, just as they are of the existence and quality of continuation training in the field. Thus, STAN/EVAL concerns are often in the interests of assessing the probability that some particular student can handle some particular contingency which is likely to arise in the field, and for which the student has received little, if any, training. Several cases were cited in which aircraft and lives were lost due to either (1) lack of experience/training, or (2) placing unrealistic expectations on the student in continuation training or field operations.

These discontinuities between graduation-level proficiencies and operational/continuation expectations stem from two primary sources;

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(1) the lack of communication between field operations and combat crew training, and (2) the lack of clearly defined training responsibilities between the two. The argument can be made that a secondary source of discontinuity is the failure to use STAN/EVAL resources as informal or secondary liaison between ISD training squadrons and operational user communities. This liaison would greatly supplement the normal communication links between training and operations.

3.4 MAJOR PROBLEM AREAS. This subsection describes the major problems identified in the study in terms of the contributing situations and their impact on the steps of ISD. The steps, as described in AFM 50-2, are: step 1, Analyze System Requirements; step 2, Define Education/Training Requirements; step 3, Develop Objectives and Tests; step 4, Plan, Develop and Validate Instruction; and step 5, Conduct and Evaluate Instruction. These steps constitute the basic "official" Air Force ISD model discussed earlier in this section.

3.4.1 Implementation Factors. Factors which significantly and directly affect the implementation of ISD are discussed herein. They are summarized from data pertaining to policies, directives and regulations as well as the charter and scope of the various ISD projects.

3.4.1.1 Situation (Imbalance Between Authority and Responsibility). Presently, there is no ISD master plan at the Air Staff level. At the major command level a limited amount of direction and guidance is provided to the training/school squadron. Thus, implementation plans and schedules must usually be derived at the squadron level. These squadron-level plans and schedules are submitted to the appropriate major commands for approval and for manning, management and monitoring support.

Problem. The lack of top-level management guidance and direction frequently results in an imbalance in both ISD responsibility and authority. It also results in ad hoc management and development practices. With respect to responsibility, the major portion is delegated at the squadron level. Moreover, going from lower to higher command levels, the practical experience diminishes. With respect to authority, the pattern is reversed such that authority is cumulated at the major command level and above while at the squadron level it is minimal. Thus, the greatest responsibility resides at the

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level with least authority but greatest experience. Without an authority base which is commensurate with the responsibilities, it is often difficult to obtain local cooperation.

Consequences.

- Impact of this situation is felt in all 5 steps of ISD. The scope-of-effort and support requirements for analyzing system requirements (step 1) are not well understood above the squadron level, and at the squadron level, neither adequate support nor authority are available. Consequently, to accomplish this step requires the combination of higher level authority with lower level experience. This combination is not often attained, with the result that analysis is incomplete or poorly performed.

- The complete definition of education/training requirements (step 2) depends upon the accomplishment of step 1, above. Thus, the lack of support to accomplish step 1 impacts step 2 indirectly. In addition, step 2 itself requires support and resources. The imbalance in responsibility and authority consequently impacts step 2 as well.

- The development of objectives and tests (step 3) must await the completion of previous ISD steps and, in addition, requires continued support and authority for accomplishment. For example, in this step the performance standards must be established for the entire program, a task which requires the cooperation and support of all local training sections.

- Planning, developing and subsequent validation of instruction (step 4) are dependent on a complete and comprehensive set of learning objectives. Therefore, these objectives should properly await the completion of the previous 3 steps and also require continuing support from personnel with unique training/educational expertise. The authority base is particularly important to validation since this process requires basic cooperation of the local training agencies. Thus, this step is substantially impacted by the imbalance.

- The conduct and evaluation of instruction (step 5) are subject to the same constraints as the previous step. All four previous steps of ISD must have been accomplished, while experienced support is required to accomplish the current step. A base of authority is again critical due to the dependency on the cooperation of local training agencies and of field units. Thus, step 5 of ISD is impacted by the imbalance.

3.4.1.2 <u>Situation (Anomalies in Policies and Directives)</u>. Historically, AFM 50-2 has served as a source document for ISD. It was supplemented by AFP 50-58 which was intended to provide detailed guidance and procedures for ISD implementation. Later, AFR 50-8 established policies, responsibilities and guidance for applying the ISD process and became the official ISD directive.

<u>Problem</u>. Though AFM 50-2 outlined policy for ISD, it was not clearly directive in terms of responsibility. That is, lines of responsibility were never established for ISD implementation. This resulted in ambiguities such that for many years major commands failed to respond to ISD. The corrective, AFR 50-8 was an effort to reduce these ambiguities; however, it is plagued itself by a "loophole" provided in the discussion of levels-of-analysis. That is, a training system not disposed to devote full-scale effort to ISD conversion can present the argument that such an effort would not provide a cost-effective solution of training problems. The alternative is to perform ISD on only selective portions of the existing program.

<u>Consequences</u>.

- Direct impact of this situation is on the analytic steps of ISD defined in AFM 50-2. Level 1 analysis as defined in AFR 50-8 clearly implies the need for a full-scale analysis of system requirements (ISD step 1) whereas Level 2 calls for the analysis of only <u>selected portions</u> of the existing program. Thus, Level 2 decisions, based on cost-effectiveness, never provide a comprehensive analysis of the complete set of training requirements. Thus, there is an incongruence in policy between the levels. Moreover, Level 2 analyses typically provide a lesser level-of-detail for the portions selected than is the case for Level 1. They often stop short of specifying objectives at the detailed level, and may be deficient in terms of conditions and standards of performance.

●  The remaining steps of ISD are indirectly impacted by the
   lack of a complete, detailed analysis. The end product
   of Level 2 analysis is, at best, a partial set of learning
   objectives, conditions and standards. To the degree they
   are incomplete, the remaining steps fall short of a full-scale
   implementation. Later problems in integrating ISD and
   non-ISD portions of the training program are also to be
   anticipated.

3.4.1.3 Situation (Over-emphasis on Media). It is common practice
for ISD projects to invest a disproportionate amount of time and money
in the development of audiovisual media. In many cases media develop-
ment is undertaken before the requisite analyses are complete. This
premature undertaking probably occurs because of local and higher
command level requirements to display visible end-products correlated
with time and man-power expenditures. Certainly the usefulness of
videotape and sound/slide modules to training is easier to demonstrate
than that of the reams of paperwork associated with seemingly endless
mission/function/task analyses. Furthermore, the usefulness and
effectiveness of analysis are difficult to demonstrate, particularly in
the early phases, whereas mediated products have a certain built-in
face validity.

Problem. This situation culminates in a wide array of problems, the
major ones of which are noted. One of the more profound effects is
found in the fact that identification of ISD with media and the con-
fusion of delivery vehicles (TV, learning carrels, etc.) with the ISD
process generate almost universal confusion and misunderstanding.
These effects, in turn, lead to resentment toward, and resistance to,
ISD, particularly locally. Though local training personnel may be
unknowledgeable regarding the recent advances in training technology,
they typically possess a good perspective, based on experience, re-
garding what constitutes good training. The proliferation of quantities
of sound/slide modules, without appropriate front-end analysis of
media requirements, is recognizably bad practice; thus, the source
of much of the local resistance appears to be justified.

Also, the scope of effort required to update and revise mediated
material, once produced is quite large. To take a common example,
simple Dash-one changes must be tracked through cataloging/filing
schemes, through all pertinent written and graphic material (including

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instructor guides and workbooks) through photographic and/or videotape processes, through material presented to the students, etc. This problem is compounded by slow turn-around times of the various facilities, whether local or remote, and by the fact that many ISD personnel are released to previous assignments before revision/updating processes are initiated.

Maintaining the focus of attention on media results in the absorption of most of the time and personnel allocated to the entire ISD conversion, partially because of the demands of media development and partially because the training of ISD personnel is, in many cases, oriented in this direction.

As a result, the essential analytic steps of ISD are postponed indefinitely. Training squadrons which must depend on remotely located production facilities are particularly vulnerable to both having the entire ISD effort absorbed and to extremely long turn-around times for corrections and revisions during which many of the modules are useless for student training.

Consequences.

- Primary impact on the analytic steps of ISD. The focus on media absorbs a disproportionate amount of resources and time, which is stolen from analysis. The definition of education/training requirements is an analytic process which should provide essential input to media selection and development. In fact, the media are usually selected or imposed prior to analysis. The development of objectives and tests, though usually accomplished, is not approached on a systematic basis.

- Given premature mediation, steps 4 and 5 are similarly lacking in a systematic approach due to an a priori bias in favor of preselected media.

3.4.1.4 Situation (Training Time Allocations). Most current ISD projects are associated with training systems which were in place at the onset of ISD. As a result, the amount of time associated with each segment or portion of training was already established. These time allocations are very difficult to change since the potential impact

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extends beyond the changed segment itself. Reduction of the total time spent in academics, for example, might mean that either student entry dates must be rescheduled, or, alternatively, the next phase of training must be moved back in time. In other cases, the student might have to endure idle time or take leave at the end of training because of the entry date to his operational squadron.

Problem. As a result of the rigidity of schedules associated with pre-ISD training, the tendency is to try to fit the converted program into existing time frames. The result is that potential time-savings associated with ISD cannot be efficiently utilized, which, in turn, reduces the cost-savings that might accrue. In addition, it is not always the case that a systematic approach results in training time reductions. In isolated cases analysis reveals the requirement for more than is usually allocated. In any of these cases an external or situational time constraint is placed on ISD conversion.

Consequences.

- Direct impact on steps 4 and 5 in that rigid time frames severely bias the results of both validation and evaluation processes by confounding both cost-and time-savings. Also, impacts the capability of the training system to provide individualized or self-paced training (step 4) insofar as such training clashes with existing schedules.

- Indirect impact on analytic steps insofar as prejudgements regarding time allocations, and consequently amount of material to be covered, occur.

3.4.1.5 Situation (Accountability of ISD Products). Accountability for ISD projects and products is not centralized. The various project groups consequently report status and progress to different local agencies, and, at times, to different higher command agencies.

Problem. The problem is basically one of uniformity in quality control. The higher level controlling agencies are apt to impose different conditions and maintain different standards among themselves for accomplishing the tasks. One result of the problem is that the project groups are not able to work together efficiently. Another is that integration of the products in subsequent phases of ISD is difficult.

Consequences.

- General impact on <u>internal</u> integration of any step of ISD in which the total effort is divided among several project groups.

- Significant <u>direct</u> impact upon the analytic steps. For example, the different aircrew members (P, CP, NAV, etc.) are usually responsible for doing their own portions of the task analysis, and usually report to different supervisors. In such cases formatting, content and emphasis of the task data vary widely.

- Impact on the latter steps is due to difficulties in integrating the various uncorrelated steps and portions of the program into a unified training system. Difficulties increase with the number of crew members on the weapon system as well as number of task groups assigned within any ISD step.

<u>Summary.</u> The preceding paragraphs within subsection 3.4.1 have discussed an imbalance between authority and responsibility; the deficiencies and anomalies in the ISD policies and directives; the over-emphasis on media which is observed in some commands and squadrons; the difficulties in varying existing training time allocations; and finally, the difficulties associated with noncentralized accountability practices for ISD products. Generally, these problems are considered to be intangible in the sense that they are based on misunderstandings, discontinuities in documentation, lack of experience, etc. They are of the sort which often develop with emerging technologies, yet, at the same time, are very difficult to anticipate. Their impact renders task accomplishment very difficult; thus they are primarily viewed as implementation factors, even though there is overlap with other factors dicussed in this report.

3.4.2 <u>Organizational Factors</u>. These factors are summarized from data pertaining to the organizational structure and integrity of ISD both within and between command levels. Of concern is the impact of structure and integrity of ISD on on-going activity and, in turn, the impact of this activity on the organization and functional integrity of ISD.

3.4.2.1 <u>Situation (Effects of ISD Representation)</u>. ISD is sparsely represented at Air Staff. For a long period of time the key ISD position within Deputy Chief of Staff for Operations and Readiness (XOO) was vacant. A very little activity was accomplished informally by interested Air Staff personnel holding other positions. In addition, manning cutbacks threaten to reduce even further, if not eradicate altogether, ISD representation at Air Staff. For these and perhaps other reasons, policies and guidelines for the implementation of ISD are not always clearly defined nor optimally situated for accomplishing ISD. For example, practice is to establish the authority base for ISD at the Major Command (MAJCOM) level although primary responsibilities for ISD are established at the squadron level.

<u>Problem.</u> The situation appears to contribute to certain difficulties in the resolution of conflicts which occur at the squadron level. With the exception of inspection procedures (IG) originating at Air Staff level, the highest base of authority for ISD is either the MAJCOM or numbered Air Force. At these levels, agencies affiliated with ISD are usually co-equal with agencies affiliated with other training activities, all of which are implemented at the squadron level. At the squadron level there is almost always some resistance to the implementation of ISD. At least initial resistance is found in academics, simulator and flight line sections as well as STAN/EVAL. Typically, the resistance from STAN/EVAL is longstanding as is sometimes the case with the other training sections. In any case, such conflict must be raised to headquarters (MAJCOM) or numbered Air Force for resolution. Squadron-level ISD teams are not always able to obtain the type of support required to overcome local resistance from these levels. In such cases, conflict resolution must await the next staff inspection visit or policy statement. Thus, the lack of clear-cut policy guidelines from Air Staff and the lack of ranking authority at MAJCOM level have seriously impeded the progress of ISD at the squadron level.

Consequences.

- General impact on any and all steps of ISD which require cooperation and support of local agencies.

- Primary impact on step 3 since the development of objectives and tests ideally would require the cooperation of STAN/EVAL which must, as an absolute minimum, agree to use the tests. In the ideal case, both objectives and tests would be cooperatively developed by ISD, existing training sections and STAN/EVAL.

- Secondary impact on the analytic steps since, in principle and given enough time, analysis can be accomplished with minimal support from knowledgeable subject matter experts. Such an approach, however, is not time-effective, and it overburdens available analysts with operational details.

3.4.2.2 Situation (ISD Input to Training Device Procurement). The coordination of training device procurement with Air Staff is a MAJCOM function. Until recently, procurement practices have not included the solicitation of related input from ISD. At the same time, ISD teams have rarely progressed far enough in the process to be able to provide useful requirements data to procurement. In the extreme case, ISD and procurement function in isolation and, consequently, a training device is imposed on the system with minimal regard for analytically derived requirements.

Problem. At best, the situation is that of "the cart before the horse". Results of the situation take two basic forms. First, actual training requirements and training device functional capabilities are not well related. Second, given recent and/or expensive training equipment procurements, the devices themselves tend to drive the organization and structure of training.

A related problem, which also stems from incomplete training requirements data, is the tendency to specify the most advanced and expensive capabilities available (e.g., maximum fidelity including visual and full motion systems for flight simulators) rather than the minimum required for sound training.

Consequences.

- Impact on steps 2 and 3 to the degree that these steps may be biased by the existence of recently procured and/or expensive devices. That is, the device tends to drive the definition of training requirements and the development of objectives and tests such that they meet existing training equipment capabilities. In the ideal case they are independently derived by analysis.

- Continuing impact on steps 4 and 5 due to the fact that any bias or incompleteness of the analytic data reverberates throughout the entire ISD process. In this case the set of learning objectives derived by analysis and later submitted for validation, evaluation, and revision would not necessarily be the optimal set for effective and efficient training.

3.4.2.3 Situation (Autonomy of ISD). At the squadron level some ISD teams experience reasonable autonomy from local influence; others are cast in a subordinate support role to other training agencies, usually the academic or flight-line sections.

Problem. In the former case there is a tendency for local agencies to resist the ISD conversion. In the latter, there is a tendency to use the ISD team in an "errand-boy" capacity under the auspices of ISD. This latter tendency is one of many contributing to the ISD teams' subjugation to a variety of extra duties. When the ISD role is clearly defined as one of support to local existing training, it may easily become a vehicle for the expression or improvement of local training preferences. The support role is equally vulnerable to higher command-level preferences. In at least one case, on-going progress was severely hampered by conflicting, apparently preferential direction from an intermediate command.

Consequences.

- Direct, severe impact on all ISD steps. Any task within any step which requires a systematic or formal approach suffers due to the lack of centralized control and direction. All tasks suffer from general inefficiency and from the fact that many of the support functions imposed on ISD bear little, if any, resemblance to the formal process.

3.4.2.4 Situation (Effects of Revision on Schedules and Milestones).
Major tasks and subtasks which are subject to revision are included
within each of the five steps of ISD. Procedural changes to the Dash-1's
(T.O.s) as well as validation and evaluation phases of steps 4 and 5 are
major sources of change and send reverberations throughout ISD.
Revisions to audiovisual material can consume up to 60 percent of
original time and costs.

Problem. It is undoubtedly true that the scope-of-effort required for
revision was initially underestimated. Thus, original project mile-
stones and schedules were shown to be seriously deficient throughout
the Air Force. One result has been the allocation and later release of
personnel based on completion of the first iteration of specific tasks.
As these tasks prove themselves to be reiterative, ISD teams have
been plagued by manpower shortages. In the ideal case, the beginning
point of revision processes is the point at which the number of quali-
fied personnel increases. Unfortunately, in the typical case there is
a net loss of personnel. The result is that either mainline schedules
are slipped, revision schedules are slipped, or, in the extreme case,
both are slipped.

Consequences.

- Direct major impact on steps 4 and 5. Both validation and
  evaluation processes result in significant revisions to the pro-
  gram. As noted, ISD teams are typically understaffed by de-
  fault at the point revision commences.

- Indirect yet major impact on steps 2 and 3. Revisions from
  steps 4 and 5 feed back on these steps, as do Dash-1 and other
  documentation changes. Even with no loss of ISD personnel,
  a full-scale revision which is simultaneous with the continua-
  tion of the basic effort would result in 100 percent of the staff
  attempting to do 160 percent of the previous amount of work.

3.4.2.5 Situation (Identification of ISD with Other Efforts). In
several cases, the ISD program has failed to obtain and/or maintain
the confidence and respect of local training agencies and of higher
command agencies concerned with squadron-level training. In several
instances ISD personnel insisted that if they identified their efforts with
ISD, local resistance became overwhelming. Thus, local team prac-
tice became that of attempting to accomplish ISD while calling it some-
thing else. In one case it was alleged that the entire ISD project has

been incorporated within a general quality control program in order to mask its identity, in hopes of optimizing support and cooperation for the project.

Problem. This situation describes one element of the larger problem which is a general lack of support and authority to accomplish ISD. The unwillingness to identify conversion or implementation efforts with ISD is probably a reasonably effective temporary solution. However, this approach contributes to the continuing erosion of the quality of ISD products. In addition, the incorporation of ISD within some other program tends to place the host program in an advantageous position methodologically. Thus, to the degree that the host program is not oriented toward formal, systematic ISD procedures, ISD conversion or implementation efforts will suffer a loss of effectiveness.

Consequences.

- Direct methodological impact on steps 1, 2, and 3, each of which must be systematically accomplished according to pre-established rules.

- Indirect impact on steps 4 and 5, due to their dependency on the former steps. That is, these steps require inputs from the previous ones. These inputs must be carefully and accurately derived to obtain the most effective results from ISD efforts.

- General impact on the accomplishment of any step in the presence of resistance.

3.4.2.6 Situation (Cooperation of Local Agencies). For reasons such as the lack of authority at the squadron level it is difficult to impossible for ISD teams to obtain the cooperation of local training and support agencies. Historically, at least initial resistance to ISD has stemmed from academic, simulator and flight-line sections as well as from STAN/EVAL. In some cases the resistance has been long-term and exists at the present time. (This is not to imply, of course, that all local training agencies always resist ISD. In many cases the co-operation and support of local agencies is quite good.)

Problem. In the final analysis, all local training agencies must be viewed as constituting elements of the total training system. In order for a complete and systematic analysis of training requirements to be

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accomplished, the cooperation of each of the elements must ultimately be obtained. Disagreement, for example, between training standards and grading standards results in discontinuity and increased likelihood of failure from the perspective of the student. Disagreements among academics, training device sections and flight training confuse the student and thus, reduce the cost-and time-effectiveness of the entire program. Finally, piecemeal implementation of ISD, though sometimes effective, greatly increases the amount of time and effort required for ISD conversion.

Consequences.

- General impact on the analytic steps, noted above, is in terms of the cost- and time-effectivess of analytic processes.

- Specific impact on the agreement of objectives and tests, as derived by the various sections within the training system. Disagreements, which sometimes occur among the sections, often persist for long periods of time.

- Impact on the latter steps in terms of integration of the total training system. Difficulties often arise among academics, skill and flight training sections. They also arise between these sections and STAN/EVAL. These difficulties are frequently manifested as the issue of proficiency standards arises.

Summary. The preceding paragraphs within subsection 3.4.2 have discussed the effects of ISD representation; the ISD input to training device procurement; the autonomy of ISD; the effects of revision on schedules and milestones; the identification of ISD with other efforts; and finally, the cooperation of local agencies with ISD. These factors result from the manner in which the host agencies are organized to accommodate ISD as well as the internal organization of ISD itself. Attention to these factors promises to increase both the effectiveness and efficiency of ISD, primarily in terms of the output of the various tasks and subtasks.

3.4.3 Management Factors. Most of the problems reported in this study can be attributed directly or indirectly to management practices and to the lack of top-level management throughout ISD. However, many of the problems result from interaction of management factors with the other factors which are reported in this section. Thus, the

fact that a problem appears in some other subsection of this section does not mean that it has no management impact but rather that the management impact was judged to be secondary or indirect as compared to the other factor. This subsection includes only those problems in which the impact of management factors is judged to be direct or primary.

3.4.3.1 Situation (Deficiency in Management Skills). Neither the current documentation (e.g., AFM 50-2 and AFP 50-58) nor the various formal and informal schools for ISD address the management of ISD programs. Air Staff provides policy and limited direction and guidance to the major commands, but is primarily responsible for coordinating the support functions for the various programs. Major commands, in turn, delegate primary management responsibility to lower echelons. Thus, the training squadron becomes the executor of management practice at the implementation level with little help from the higher commands. In turn, while knowledge and skills appropriate to ISD management are deficient at all command levels, the deficiency most severely impacts ISD at the squadron level.

Problem. Squadron-level ISD teams typically characterize the problem as a breakdown in middle management. Personnel at higher command levels note the absence of management skills at all levels. The latter perspective is the more accurate due to the fact that no management guidelines are provided in the existing documentation and little or no management training is provided at any level. In fact, it would be difficult to pinpoint either a top- or middle-management group or function at any command level, except in the nominal sense. The management void stems directly from a general lack of standardized ISD management procedures and standardized, or centralized, training programs directed specifically at ISD management functions, as presently exist for the implementation functions.

Consequences.

- Direct and very severe impact on all steps of ISD. Within any major step as defined by AFM 50-2, the impact is felt at the level of tasks and substasks.

    - Impact on the analytic steps is typified by the variability of approaches to the basic task analysis. These are accomplished in varying degrees of detail and completeness. They are approached both from the basis of the

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weapon system mission profile and that of existing classes, simulator sessions, etc. Both approaches some-times occur within the same command, leading to the problem of later integration of task data.

- Impact on the other steps is typified by difficulties in production, documentation, and revision of training materials; in synchronizing the various portions of the training system; in arriving at universally acceptable interim and terminal proficiency standards; etc.

● Direct impact on the major thrust and direction of the effort; for example, media and the production of mediated course material often dominate the available time and resources, as mentioned earlier. In such cases the existing management practices are singularly oriented toward step 4 (AFM 50-2) such that the preceding step is often slighted or left incom-plete. The resulting preselection of media (that are not systematically derived from the learning objectives) reflects a limited management vision and subsequent inability to balance the available effort appropriately over each of the five major steps.

3.4.3.2 Situation (Nonstandardized Approaches to Management). Responsibilities for coordination and liaison with supporting agencies at the squadron level do not reside with MAJCOM, but with the local ISD team chief. Though management authority officially stems from MAJCOM level, it is effected at the squadron level and results in nearly total autonomy and a wide variety of nonstandardized manage-ment approaches at this level.

Problem. The variety of management approaches are possible because the major commands delegate primary program responsibility to the training squadron, as described in the preceding problem statement. The resulting program autonomy at the squadron level, in turn, allows for variations in the programs due to local constraints and unique fac-tors associated with the host agency. In over half of the training squadrons interviewed, resistance to ISD on the part of local training and (to a lesser extent) support agencies was the primary instrumental factor in shaping the approach taken by the ISD teams. In these cases the approaches were essentially derived in response to the charac-teristics of the local resistance. Representative examples include:

● A case in which the ISD team is subordinate to the operational squadron; consequently ISD, which resides within the training

squadron, cannot obtain the cooperation of the flight line. Progress in the ISD conversion is consequently limited to the academic and simulator sections.

- A case in which neither the training squadron nor the headquarters level ISD group has the authority to obtain the cooperation of the flight line. Again, the progress made by ISD is limited to academic and synthetic training.

- A case in which the ISD team is unable to obtain the cooperation of the local academic section, largely because portions of academics perceive an undue emphasis on production of sound/slide modules and other mediated material. (It was noted that many of the modules remain unusable for long periods of time because of the revision process turn-around times.) In this case, the primary emphasis of ISD has been on the simulator program.

In such cases, the issue is only partially one of a lack of appropriate management skills. In addition, regardless of the approach taken, ISD is left with only a part of the total training system to manage, and the ISD conversion process remains incomplete until the resistance diminishes. The management approaches taken must presently work around the various sources of resistance for progress to continue. It is clear that until the resistance does diminish, no management approach chosen can attain the ideal of maximal cost- and time-effective training.

Consequences.

- Impact of these variations can be severe or minimal on the analytic steps of ISD. In principle, analysis may be accomplished with the support of very few operationally qualified personnel, though the fewer available, the greater the time requirements for analysis. Such cases impact the program for limited periods, since analysis is ultimately completed. On the other hand, a management approach which shortcuts or bypasses analysis altogether has enduring or permanent impact which is felt in later steps, due to the fact that later steps utilize the baseline analytic data as a point of departure for their own operations.

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- Impact on the development of objectives and tests (step 3) is additional to that of an insufficient data base and varies in severity, depending on the source of resistance. A typical case is witnessed in the event that resistance stems from STAN/EVAL. In this case, there is no way to synchronize STAN/EVAL grading standards with the standards of proficiency which are derived for training. The result is that the student is trained to one set of standards and graded on another. Discontinuities between training and grading practices may be particularly costly since they increase the likelihood of two specific types of errors. The one is the error of "washing out" a potentially highly-qualified student, with the subsequent loss of a sizable investment made in his previous preparation and training by the Air Force. The other is the error of letting the poorly-qualified student graduate, with an increasing risk of later losing airplanes and lives.

- Steps 4 and 5 are similarly impacted. Planning, development, and other activities leading to the final implementation of instruction are also dependent on the cooperation of the local training agencies and on unified management. For example, the validation of an instructional block (step 4) cannot occur without the cooperation of the training section for which it is intended. The evaluation process (step 5) leading to revision of the first iteration of ISD is seriously hampered without the cooperation of all training and proficiency grading sections.

3.4.3.3 Situation (Traditional Management of ISD Programs). In three cases at the squadron level the ISD teams had made deliberate efforts to either identify the ISD programs with other programs and projects or to minimize attention to the identity of ISD. A representative example is the case in which ISD functions under the auspices of a general quality control program associated with all of training. In all of the cases there was a predominant tendency to manage ISD conversion according to traditional pre-ISD instructional philosophy. A plethora of other reasons exist for traditional management practices, among them: a lack of ISD management training (noted in subsection 3.4.2.1 and elsewhere); a better understanding of, or preference for, traditional training or training management; a lack of confidence in the quality of ISD training. Independently of the reasons, the point here is that traditional management practices and preferences are prevalent more than 6 years after the introduction of ISD to the Air Force.

Problem. Traditional pre-ISD management techniques are not usually adequate to the full-scale conversion of the Air Force's complex training systems. Though largely a straight-forward systematic process, ISD is both cumbersome to apply and imbedded with problems whose *solutions are neither apparent nor amenable to common sense.* These problems include the translation of task analytic data into behavioral learning objectives (with conditions and standards of performance) and the subsequent translation of these objectives into algorithms for the selection of appropriate media. Also included are the methodological processes associated with validation, evaluation and revision of instruction, which are equally important and quite complex.

Traditional management practices are vulnerable to the tendency to try to teach a level of knowledge and skills appropriate to several years' operational experience rather than need-to-know items appropriate to the student's current proficiency. This practice, in particular, tends to prevail to the point that cost and time savings, which are sometimes possible with ISD, are never realized.

Traditional management is a contributing factor in the premature engagement of the media selection process, and the related tendency to underestimate the magnitude of revision processes, particularly the revision of mediated materials. Complications in these processes seriously interfere with project schedules and future plans (1) by absorbing labor hours and (2) because of slow production and turn-around times of mediated instructional material. (Though somewhat unrelated to the present issue, it is noted here that other contributing factors are: (1) ISD schools in the Air Force are strongly oriented toward media development and production, and (2) the pressure from higher command levels for visible products to show for time and personnel investments in ISD. )

Finally, due to the fact that many of the tasks within the major steps of ISD have yet to be accomplished (completely and comprehensively), there are no good, empirically-based operating models to follow. Tasks yet to be completed include a complete and exhaustive task analysis; a complete set of learning objectives derived from the task data; a comprehensive listing of the mission requirements (for recently acquired weapon systems); a media selection effort which is formally based on the behavioral characteristics of the learning objectives; and finally, an ISD revision effort which has gone beyond the level of instructional modules to include a major instructional block or segment of training. These and other examples indicate that ISD management is constantly

faced with factors whose scope, magnitude, and operations are largely unknown. Thus, even management policies which are deliberately and methodically centered on the ISD approach are likely to encounter significant difficulties. Any other management policy, if it prevails, is likely to fail in some important aspect of ISD conversion, with subsequent impact on either the effectiveness or quality of training.

Consequences.

- Direct impact on the accomplishment of all five steps of ISD. In the analytic steps, it is important for existing management to recognize not only the scope and magnitude of the effort involved but the nature of the tasks and subtasks involved as well. Failure to do so can result in either incomplete, marginally useful data; or, alternatively, a disproportionate cost and time investment for accomplishing analysis.

- In the remaining steps it is important to recognize the necessity for deriving media requirements, instructional blocking/sequencing algorithms and many other ISD tasks from analytic data in a systematic and formal way. Failure in this respect typically results in an instructional program which is distinguishable from the pre-ISD program in only minor ways.

- In the non-analytic steps it is also important that management be aware of the unique requirements (for accomplishing these steps) which are independent of the analytic baseline data. That is, in addition to the analytic basis, there are systematic processes which must be implemented in the development of objectives and tests; the planning, development, and validation of instruction; and the conduct, evaluation, and subsequent revision of instruction. Management personnel with little ISD experience are not likely to be aware of these processes and would have difficulty in setting the associated efforts on their proper courses.

3.4.3.4 Situation (Resistance to ISD by Management-level Personnel). In many cases, Air Force personnel with authority and rank appropriate to management of training do not understand the general nature and direction of ISD. These personnel constitute a source of resistance which is distinct from that which is based on principle. In the former category are personnel who provide increasing support the more they learn about the process. Those opposed to ISD on principle refuse to believe that the more complex tasks performed by aircrew members

are subject to objective analytic treatment. For these latter person-
nel there is no substitute for extensive time at the controls. Also in
the latter category are those who are simply unconcerned about sys-
tematizing the existing instructional system since they are convinced
it is a fruitless endeavor.

Problem. Both categories function in such a way that general progress
in ISD conversion is hampered. With regard to the former group, the
problem is clearly one of insufficient information regarding both ISD
and management of ISD. As noted, these personnel provide increasing
support and management expertise concomitant with their level of
knowledge. The problem stems from the initial lack of information
and training regarding ISD management, and is typically a short-term
problem. With the latter group of personnel, the source of the prob-
lem is similar in one respect; that is, a general lack of objective or
believable information. However, their resistance to ISD is typically
enduring and difficult to overcome. A few cases were observed in
which former resistance, based on disbelief in the principles of ISD,
was eventually converted to strong support. Interview data from the
personnel involved indicated that coupled with insufficient information
about ISD in the deeper problem of the way ISD was initially presented.
The initial exposure of operational personnel to ISD (an unfamiliar
technology with complex ways and means, a unique jargon, and little
face validity) is confusing at best. When badly presented, with irrel-
evant examples (use of the M-1 rifle) and insufficient explanations, or,
when imposed by higher authority and espoused by specialists with no
aircrew experience, it becomes an intimidation and annoyance. Thus,
a degree of resentment is added to the confusion, the result of which
is a long-standing and predictable resistance.

Consequences.

- Insofar as management-level personnel (typically, rank above
  Captain) are involved, the problem affects all five steps of
  ISD.

  - Steps 1 and 2: At the management level, the analytic steps
    require both organization and the appropriate allocation
    of personnel. Resistance to either step results in dis-
    proportionate amounts of time to accomplish analysis,
    the reduction of quality of analysis, or both.

- Step 3: Resistance in this step impacts the ultimate quality of instructional material for which the student is responsible. In addition, the familiar problem of aligning proficiency levels, grading standards and test objectives among the local agencies presents itself. Functionally, step 3 suffers the greatest impact of the disagreement between combat crew training sections and STAN/EVAL regarding grading standards and objectives.

- Steps 4 and 5: Management-level resistance results in both organizational and methodological problems in these steps. Regarding organization it may suffice to mention the complexities of ISD and the increasing need for local cooperation. Regarding methodology, for the maximum objectivity, both validation and later evaluation processes require the application of an experimental-empirical technology. In the typical case, management must at least know how best to apply the available personnel with technical and academic backgrounds and/or how to find them. Moreover, Air Force ISD schools could probably serve management requirements better by placing greater emphasis upon the construction of objective, quantitative proficiency tests and processes for the verification of the quality and appropriateness of instruction.

3.4.3.5 Situation (Preferences in Approach to ISD). There are local variations in the use and interpretation of official Air Force ISD manuals, pamphlets, regulations, etc. At the squadron level, an approximately equal number of ISD teams expressed a preference for AFM 50-2 as they did for AFP 50-58, in the implementation of ISD. Almost all of the ISD teams supplement their preferred implementation document with locally-produced command supplements, policy and guidance statements.

Problem. Local documentation preferences are used in defense of the wide range of approaches, procedures and philosophies associated with Air Force ISD.

Although verifiable differences between the documents noted above are nominal, local preferences and variations in approach to ISD persist. The result is that difficulties arise in finding methodologically sound ways of comparing and contrasting ISD variables across commands and from lower to higher levels within a command. Local preferences

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might also partially account for the general lack of cross-talk among commands, since, to the degree the preferred approaches actually differ, the various ISD programs would be on different tracks and the various ISD teams would appear to be speaking different languages. Though this latter point is largely speculative, variations may indeed be observed, and are probably greatest between squadron ISD teams which are Mager-trained (with greatest emphasis upon analytic techniques) and those which are media-trained by existing Air Force ISD schools.

Consequences.

- Impact on any or all steps of ISD, depending on a number of factors; among them: (1) the preferred model itself might be different, thus the emphasized steps would differ from those of AFM 50-2; (2) the shift in emphasis from one step to another due to variations in approach; for example, many of the commands invest a large effort in media production, to the partial exclusion of other steps.

3.4.3.6 Situation (Problems with Cumulative Management Impact). A number of squadron-level practices have been identified which, taken in isolation, constitute only moderate management problems for ISD. Taken together, however, their effects are cumulative and become more serious. These practices are discussed together here:

- The various local training agencies were brought into the ISD process at different times and/or for different ISD tasks.

  - Impact on the synchrony of project milestones, schedules, etc. Due to interdependencies among ISD tasks and sub-tasks, synchronization problems drastically reduce time-effectiveness, and equally drastically increase management difficulties. The effects are similar to having to manage several different programs at one time.

- Separation of training facilities/locations; in an extreme case two different Air Force bases were used, one for the teaching of knowledge items, the other for the training of skills.

  - Impact on the management and coordination of training from one phase to the next. Training is discontinuous from student perspective, in the sense that academic

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instruction is completely separate from the acquisition of skills which are taught in training devices and simulators. By precluding any opportunity for early hands-on training, this separation postpones the integration of knowledge and skill items. The separation also prevents the most effective integration of the total program, i.e., academic, synthetic and flight instruction; hinders instructional sequencing and blocking; and finally, prevents application of sound learning principles.

● The tendency (independent of its reason) to perform ISD on only a portion of training, for example, only flight or only ground training.

  – This tendency also impacts the management and coordination of training and leads to discontinuities (between ISD and conventional training) among learning objectives and among instructional blocks. Also interferes with sequencing of instruction and with program integration in general.

● Segregation of the ISD team from other training agencies as opposed to incorporation within a training agency, such as academics or the simulator section.

  – Can result in either positive or negative impact. Positive impact in the case that segregation leads to an objective view point. In this case, ISD can provide an overview, guidance, and direction for the entire training program.

  – Negative impact in the case where ISD is simply isolated from the major training sections. In these cases ISD is typically able to establish itself within only one section, for example, academics, and is isolated from the others.

● Complications in the handling and treatment of classified materials.

  – Impact (largely in terms of time consumption) on documentation, preparation, storage and distribution practices. Accessibility and need-to-know problems both within the ISD team and in cases of contractor assistance. Also problems of transporting and mediating sensitive material when limited access is required.

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Taken together, these problems constitute more of an issue with the time requirements and continuity of ISD than with anything else. They are reflected in impeded progress, disrupted schedules and milestones, and, in escalating time, labor and management costs.

Summary. This subsection has discussed factors which critically impact management as well as those factors which are critically impacted by management practices. They include discussions of deficiencies in management skills; nonstandard approaches to management; traditional (non-ISD) management of ISD programs; resistance to ISD by management-level personnel; local preferences in the approach to ISD; and finally, problems with cumulative management impact. Solution of these problems would enhance the ISD process by means of enhancing effectiveness and efficiency of management personnel.

3.4.4 Personnel, Resources, and Facilities. These factors impact ISD conversion in a variety of ways, some of which have been noted in other subsections due to interaction and/or overlap with other factors. They have been summarized from data specific to the factors and have not been combined with or collapsed into other, more general factors.

3.4.4.1 Situation (Identification of Personnel with ISD Experience). Headquarters-level qualification standards for assigning personnel are not formalized. In addition, procedures for increasing manning are poorly defined at all levels. At the time of the data collection portion of this study no Special Experience Identifier (SEI) existed to identify personnel who have ISD experience but are not ISD technicians. *
Such personnel are those most apt to have ISD management experience as opposed to implementation experience. The problem is compounded by the practice of some commands/squadrons to terminate ISD slots on completion of a particular task or subtask. The Manpower Evaluation Team (MET) effectiveness in meeting manning requirements for ISD is variable with squadron reports ranging from "excellent cooperation and staffing" to "nonfunctional." Although no reasons for these variations were elaborated, squadron personnel frequently reported they had little or no interaction with MET personnel.

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*The SEI was erroneously identified as an Air Force Specialty Code (AFSC) in the original draft of this report and a Data Summary submitted October, 1977. The error was corrected by means of correspondence from Technical Director, Training Systems Development (DCS/Plans), Randolph Air Force Base.

<u>Problem</u>. Resulting problems are those of location, allocation and retention of ISD personnel. Though increasing in both number and visibility, there are still relatively few well-qualified ISD personnel available within the Air Force. Those available tend to disappear into the system and become, subsequently, very difficult to find. The practice of releasing these personnel upon completion of their immediately assigned duties does not necessarily free them to accept other ISD responsibilities. Rather, they are typically transferred to a non-ISD slot. This problem contributes to an exceptionally high turnover rate among ISD personnel (up to 75 percent in a 15 month period for one squadron). These problems (including MET effectiveness) result in the case that some squadron ISD teams are adequately staffed with well-qualified personnel and others are not. For those which are not, the inability to locate, employ and retain ISD personnel becomes crucial with regard to ISD progress and quality.

<u>Consequences</u>.

- Impact on all steps of ISD. The primary characteristics of the impact are: (1) discontinuities among tasks and subtasks due to the frequency of stopping and restarting the tasks with new personnel, and (2) overall program discontinuity due to variabilities in management approaches, philosophies and understanding of the frequently changing personnel.

  - Impact on the analytic steps is to contribute to the wide variety of approaches to analysis, with subsequent variations in quality, completeness and level of detail. Later impact on integration of analytic data for development of learning objectives, proficiency tests, etc.

  - Impact on steps 4 and 5 can be particularly costly. As noted elsewhere, both validation and evaluation of instruction require a level of methodological expertise; the methodological approach must be unified and continuous. Discontinuities and disruptions to the approach degrade the validity and reliability of validation/evaluation steps.

3.4.4.2 <u>Situation (Time Spent on ISD versus Extra Duties)</u>. In addition to the difficulties of obtaining qualified ISD personnel, once assigned, these personnel are typically saddled with an array of extra duties. In many cases they must continue to provide classroom lectures, simulator or flightline instruction. Most commands require

rated personnel to maintain their flying status, although one noted the initiation of a policy of releasing ISD team members from extra duties during the time they are assigned to the ISD team.

Problem. ISD personnel who have extra duty requirements cannot devote full time to ISD. In the case of personnel for whom ISD itself is an extra duty, the amount of time devoted is even less. Some commands, recognizing the problem, have conducted local studies to determine how much time is actually spent on ISD as compared to that spent on other duties. ISD specialists with no flying responsibilities commonly spend 50 percent or less of their time in actually accomplishing ISD. Estimates for rated personnel and instructors range downward to 25 percent or less time spent on ISD.

Consequences.

• Impact of time and labor shortages is felt in each of the five steps of ISD, depending on when and where they occur.

• Impact is probably greatest in analytic steps where the penalty of interruptions to efficiency is most severe; for example, breaking train-of-thought, or, requiring location and storage of source material. Extra duties are thus one of the reasons task analysis sometimes remains incomplete after 2 or even 3 years of effort.

3.4.4.3 Situation (Training/Experience of New Personnel). Interacting with the high turnover rate for ISD personnel is the fact that newly acquired team members almost always require training specific to their ISD responsibilities. This training sometimes consumes up to a year's time, depending on task assignments and previous experience. Subject matter experts, in particular, rarely ever arrive on an ISD team with previous ISD experience, although their services are essential for the analytic steps. Though it is more likely for audiovisual, graphics and other technical personnel to have had some prior experience in ISD, many have no experience and require various amounts and kinds of additional training. Whereas some require only a reorientation to the specific characteristics of a new (for them) program, others are in the position of the new SME and require extensive training. In addition, the training ultimately received varies widely and is often specific to particular tasks and subtasks.

Problem. At present, ISD is more than an approach to training; it is a training ground in and of itself. At any given time a significant proportion of ISD team personnel are in the process of learning about ISD. At the same time, currently available training varies widely, the major approaches being formal (usually Mager-oriented) in-house training; the various available Mager schools; formal command-level schools (ATC); and, on-the-job-training. Thus, in any one ISD program, personnel experience levels representing wide ranges of proficiency as well as a variety of approaches, philosophies and biases are encountered.

Benefits as well as drawbacks accrue to this situation. Among the benefits are the increasing dispersion of ISD knowledge and philosophy throughout the Air Force and the constant refinement of the process itself due to cross-talk and exchange of ideas among the various schools, philosophies and approaches. Drawbacks are that only the few personnel with a great deal of experience and/or an adequate technical background are currently performing ISD duties efficiently. For those still learning, output is understandably less. For those with extra duties which consume up to 75 percent of available time, their progress in ISD often grinds to a halt for long periods of time. Moreover, the variations in training lead to inconsistencies and discontinuities within the program itself. Among these are the multiplicity of approaches to the familiar task analysis and the tendency to focus effort upon only a portion of the overall program such as media development. In addition, on-going programs have suffered drastic directional changes and other setbacks due simply to the turnover of key personnel. These effects are particularly severe when the turnover is at the management level and when incoming personnel represent different philosophies, approaches and experience levels than those they replace.

Consequences.

- The general result of these factors is to reduce the effectiveness and efficiency of ISD personnel in all major steps of the process.

- Pronounced reduction of efficiency and lack of direction in the analytic steps. For example, a historical disagreement regards whether the best approach is to "ISD" the entire training program at once or, alternatively, to tackle one portion at a time. Both arguments have merit, particularly

the latter in cases of an undermanned staff or high local resistance to ISD. However, lack of experience combined with the latter approach often results in an incomplete or unusable task analysis. For example, when task analysis is performed only on material for selected portions of training, the effort is based on preselected knowledge and skills rather than actual weapon system requirements.

- Additional impact on analytic steps is due to reducing the above approach to a simple need-to-know analysis on the selected material rather than attempting the formal or full-scale task analysis. Unfortunately, in addition to the inadequacy of this approach, nice-to-know items initially culled out are often reinserted in later tasks by personnel with different opinions or philosophies about ISD. When carried to extremes, this practice can render the analytic effort meaningless, with the ultimate result being very little significant change to existing training.

- The variability of approaches to ISD interacts with the need to demonstrate some tangible product of the effort, often prematurely, in such a way as to increase the emphasis on media selection and the production of modules. In addition, much of the experience and training currently available is centered on media development and production rather than on ISD itself. There is often a blurring of the distinction of the two processes. Although expertise in media certainly contributes to the overall effectiveness of ISD, by no means does it stand in place of the complete process of instructional systems development.

- Impact on steps 4 and 5 is greatest on validation and evaluation. These processes require methodological expertise, which if not available, results in an inability to accomplish them properly. This, in turn, sets ISD revision on the wrong track, if, indeed, it is ever addressed.

3.4.4.4 <u>Situation (Use of Civilian Specialists)</u>. Civilian specialists are used widely at the squadron level. They fill both permanent and temporary positions on the ISD team; those who are permanent being possessed usually of either a technical or educational background, an outstanding operational background coupled with in-depth knowledge of Air Force procedures, or both. Those who are temporary, such as overhires, usually possess expertise in some specific task-level function important to the accomplishment of ISD. The authority, support

and cooperation provided to civilian employees, particularly the former group, varies widely. In some cases their working relationship with Air Force ISD personnel is excellent and they are able to make valuable contributions to the overall program, both in terms of obtaining support from other command levels and agencies, and of providing task-level methodological expertise and advice. In other cases, they appear to have been isolated from the mainstream ISD effort, with little advantage taken of their particular knowledge and/or background.

Problem. In some cases civilian specialists function effectively from a position of isolation or autonomy. In other cases they are simply isolated from the mainstream ISD effort and little heed is given to their inputs. For example, in one extreme case both civilian educational specialists and Air Force ISD specialists with extensive preparation (e.g., advanced academic degrees with specialization in ISD) were grouped together and the entire group was isolated from the "official" ISD/training program. Conflict between these personnel and those with operational backgrounds appeared to result from differences in methodology, philosophy of ISD and approach. It appeared that the isolated group of specialists had little or no opportunity to contribute to the program. Any effort on their part to contribute was allegedly treated as a complication, irritation, or ignored altogether. To a limited degree, such cases might result from personality conflicts among the personnel involved. It is more likely, however, that the major factor is a lack of understanding of the philosophies and technologies espoused by educational experts. Whatever the case, it was noted in this study that the blend of personnel which appeared most effective, judged by the direction and progress of ISD, involved no tendency to isolate specialists, either civilian or military.

Consequences.

- General impact on all steps, due to the inefficient use of a significant resource available to ISD. It will continue to be inefficient until conflicts and differences between the civilian specialists and AF ISD teams are satisfactorily resolved.

- Specific impact on media development, production, etc. Impact is both positive and negative. In many cases civilian specialists bring media expertise to the ISD team which would otherwise be lacking. Often these same personnel are extremely knowledgeable regarding other important ISD tasks such as task analysis, validation and evaluation of instruction.

On the other hand, a tendency to identify ISD too exclusively with mediation processes must be guarded against. (It is mentioned here that the tendency to allow media to dominate ISD is by no means exclusively due to influence of civilian specialists. Rather, this tendency was also noted among ISD teams comprised exclusively of Air Force personnel; it was noted at different command-levels and in contractor assisted programs as well.)

3.4.4.5 Situation (Constant Training Requirement for ISD Personnel). It is common Air Force policy to assign personnel to the various ISD projects for one tour-of-duty. At the squadron level, a frequent practice is to release locally assigned personnel from ISD responsibilities after they have completed one task or series of tasks to reduce the ISD manpower requirements. As an example of the latter, an SME may be loaned to ISD from the flight-line to segregate nice-to-know and need-to-know items on a portion of the task analysis. Given either the completion of the task or, alternatively, the passage of the allocated time, the SME must return to the flight line.

Problem. Both of these practices result in the initiation of a two-fold problem. First is the fact that newly assigned personnel must invariably be trained. This training is both cost- and time-consuming; moreover ISD progress is impeded until the new personnel are capable of performing adequately on the project. Second, their release, after only a limited time on the job, leaves an unfilled void in both ISD expertise and manpower. This void can rarely be filled immediately because of the continuous requirement for training new personnel. Thus, a continuing cycle of project discontinuity results.

Consequences.

- Impact on project continuity in all 5 steps of ISD, depending on when personnel loss or changeover occurs.

- Impact on cost- and time-effectiveness of accomplishing all 5 steps insofar as a significant portion of the time available to ISD must be devoted to training.

Summary. This subsection has discussed factors associated with personnel, resources and facilities of the various ISD programs. These factors include discussions of problems in identifying personnel with ISD experience; the interference to ISD of extra duties; the training/experience requirements of new personnel; the use of civilian specialists; and finally, the requirement for constantly training ISD personnel. Solutions to these problems would largely enhance the supporting processes and functions.

3.4.5  Relationship to Other Agencies/Activities.  Factors noted here are those associated with relationships which exist between the ISD team and other local training agencies or activities likely to impact, or be impacted by, ISD.  These include STAN/EVAL, Academics, Synthetics (simulators and training devices), and Flight line.  Also noted are factors associated with peripheral activities and evaluation activities.

3.4.5.1  Situation (Sources and Results of STAN/EVAL Resistance to ISD).  STAN/EVAL's resistance to ISD, when it occurs, appears to be derived from three basic sources.  The first is the chaotic and unsystematic activity which often surrounds initial efforts to implement ISD. For example, ISD teams have frequently launched the mediation effort prematurely, with the result that the entire process is perceived as being constituted of slide/tapes, videotapes or some other mediated gadgetry.  Adding to the resistance is the fact that very often mediated material is out of date, in need of revision, or tied up in the slow-moving revision process.

A second source is STAN/EVAL's perception that a backlog of important knowledge and skills is slowly being lost and ISD's need-to-know filter is contributing to the loss.  This perception contributes to the tendency to maintain and implement STAN/EVAL personnel's own standards for graduating the student.

The third is the notion (previously discussed) that higher level flying skills are not subject to objectification or quantification which, in turn, leads to an inability of STAN/EVAL and ISD to reach ultimate agreement on proficiency standards.  In some cases STAN/EVAL implements either some portion, or all, of the ISD grading standards but retains the option of implementing traditional subjective ones as well.  In other cases, STAN/EVAL simply ignores the ISD standards completely, or considers the standards to be inappropriate to STAN/EVAL function, or charter.

Problem.  Regardless of the source of resistance, the resistance itself impacts both the continuity of the training provided and the ultimate success or failure of the students in the program.  Until agreement between STAN/EVAL and ISD is ultimately reached, the student always faces a possibility of mastering all aspects of flying training to stated "training" levels of proficiency and failing the checkride on some parameter or standard unfamiliar to him.  There are a number of ways this can happen.  One is in the event the STAN/EVAL "IP" asks for a

maneuver or series of maneuvers for which the student is unprepared, yet which bears some importance to the IP. Another is in the event a situation develops during the checkride for which the student has received no hands-on training. Examples of the latter include aircraft equipment failures or unexpected weather aberrations. In the former case, any action expected of the student during the checkride should have been "trained-in" prior to the checkride. This can be accomplished by the provision of better liaison between STAN/EVAL and ISD as well as by more extensive cooperation. The latter case represents one of the contingencies for which ISD must ultimately plan. Either case demonstrates the ultimate necessity for ISD to obtain the active participation of STAN/EVAL in the development of the training objectives and standards for the instructional system.

Consequences.

- Impact on the analytical steps is the likelihood that task-analytic data are incomplete in important respects. Any knowledge or skill item for which the student is responsible, at any time during training, must eventually be addressed by ISD; thus it must be included in analysis.

- Impact on Step 3 (development of objectives and tests) is particularly severe. First, there is impact on the student who is likely to receive a surprise on the checkride, or, alternatively, is apt to fail the ride completely. Impact on the total program is in regard to the completeness of learning objectives as well as the correlation of tested objectives with trained objectives. This latter impact is particularly important. One typical approach is for the training section to identify testing algorithms employed by STAN/EVAL and structure training around them. The student is often briefed prior to the checkride in hopes he will be better prepared for surprises. This approach suffers from the discrepancy that objectives are partially based on STAN/EVAL standards and preferences rather than actual mission requirements; in particular, those which are reasonably attainable at squadron level training. Regarding this point, there are important objectives which are indeed of legitimate concern to STAN/EVAL, but which are inappropriate to the level of training provided in the training squadron. These objectives are more appropriate to continuation train- and should be addressed at the operational squadron. With the cooperation of STAN/EVAL, it would be possible to segment all objectives into one group which is appropriate to combat crew training and another which is appropriate to continuation training. With this cooperation, each training group would

know what to expect of the other; without it, training and final grading are likely to remain somewhat discontinuous with regard to what is expected of the student at his particular level of proficiency.

- Impact on steps 4 and 5 is probably less severe than on previous steps. If, however, STAN/EVAL cooperation is not available in step 3 the validation, evaluation and revision processes will be deficient precisely because their central concerns are: (1) the adequacy of the learning objectives, and (2) the ability of the tests to accurately reflect these objectives.

3.4.5.2  <u>Situation (Association of ISD Team with a Particular Section of the Training Squadron)</u>.  There is a tendency for the ISD team to associate itself closely with only one or two sections of the training squadron.  It is common for ISD to have started within the local academics section, less common for it to have started in either the simulator section or at the flight line.

<u>Problem</u>.  The impact of ISD philosophy is greatest on the section with which the ISD team is most closely affiliated.  This section is most likely to adhere to the principles of ISD whereas sections farthest removed tend to adhere to a lesser degree, or alternatively, to actively resist the implementation of ISD.  A result of this tendency is the development of objectives and proficiency standards which are uncorrelated among academics, synthetic and flight training.  Another is that the various sections of the training program become directionally specialized causing later difficuitites in the total integration of training.  (One academic section interviewed was involved almost exclusively with the review of ISD end-products.)  It also appears that these tendencies have resulted in variations in the benefit of ISD to training, with greatest benefits to academics (on the average) and decreased benefit to synthetic and flight training.  However, exceptions to these tendencies are found in regard to synthetic or simulator training.  In two of the training squadrons interviewed, the application of ISD principles to simulator programs has resulted in significant efficiencies for ground training with subsequent reductions in flying time.

<u>Consequences</u>.

- As noted, a principal consequence of these factors is the difficulty in effecting a total integration of training.  At the level of the major steps of ISD it becomes a difficulty in the total

integration of the steps themselves as well as the tasks and subtasks within the steps.

- Though impact is variable, depending on local factors and constraints, it appears to be greatest on step 3, the development of objectives and tests. The lack of integration of training (sections) in general translates ultimately into a lack of integration of the objectives in particular. Also problematic are the consequences of noncorrelated proficiency tests (due to the lack of integration of the objectives from which they are derived) to the student.

- Impact is still great on step 4, particularly with regard to planning and developing instruction. Tasks and subtasks involved specifically are those associated with blocking and sequencing instruction. These essentially reduce to exercises in the integration of learning objectives according to their behavioral characteristics, conditions and standards.

3.4.5.3 Situation (Inadequate Production Capabilities). MAJCOM support for the development of media production capabilities and related activities is reportedly deficient as compared to support for general resources. Squadron-level personnel reported a lack of cooperation of local Air Force graphics/photo facilities with the ISD team. Some training squadrons virtually incorporate graphics and other production facilities while others are remote from any such capability. One command is coordinating with the U.S. Army to obtain audiovisual production capabilities while others attempt to rely on the Aerospace Audio Visual Services (AAVS) whose response times are extremely slow due to an overload at the AAVS facility. Compounding the issue is the fact that, recently, the Air Force has demonstrated a certain ambivalence regarding: (1) whether to "civilianize" all graphics/production capabilities, and (2) whether such capabilities should be centralized or locally controlled.

Problem. The problem is simple. Basically, in commands having limited access to these graphic/production capabilities it is extremely difficult to progress at more than a nominal rate in the production of mediated learning materials. In some cases the slow progress is alleviated by personal sacrifice, for example, the use of personal transportation and time to utilize a photographic facility in a nearby community. In other cases it appears that progress is impeded by undue attention to quality control (e.g., color and hues of slides used in

slide/tape modules) and to detail (e.g., graphic illustrations). It is important to remember that the problem affects more than the initial phases of ISD, it significantly impacts ISD revision as well.

Consequences.

- Significant impact which starts with the early stages of the production of audiovisual material and continues through the first iteration and later revisions of ISD.

- Impact is on both the progress and complexity of ISD. Any training command which relies heavily on mediated material is faced with additional problems in management, storage, retrieval, revision and use of the material.

- Cross-referencing of material to accommodate Dash-1 changes is a sizable effort and is impacted in accordance with its size. The same is true for any revision process, for example, revision which results from either validation or evaluation.

3.4.5.4 Situation (Impact of ISD on Air Force Career). In approximately half of the training squadrons interviewed, ISD team personnel viewed their association with ISD as not benefitting their Air Force career. Some viewed it as having a detrimental effect overall. Similarly, squadron commanders rarely view ISD as an asset to their own careers, but rather, as a series of complex and sometimes perplexing problems.

Problem. Difficulties in identifying and obtaining qualified ISD team members have already been described. The alleged detriment to one's career appears to be the other side of the coin. That is, whereas from the team's perspective the personnel are "lost", from the perspective of the individual ex-team member there is no particular reason to want to be "found." No conclusive evidence supports the notion that ISD is in fact detrimental to one's career. However, once released from an ISD assignment, many personnel do whatever they can to obtain some other type of assignment. They clearly tend to respond to their own perceptions of the situation, independently of whether these perceptions are substantiated in fact.

Squadron and/or Wing Commanders, also tend to respond to their own perception of ISD. As the problems of ISD becomes more complex and time consuming and visible results remain minimal, their response is often to simply wait out their term as opposed to taking an aggressive, problem-solving approach. This response is possibly strengthened by a second allegation, also unsubstantiated, that sooner or later ISD will be terminated Air Force-wide and things will get back to normal.

Consequences.

- General impact on the entire ISD process. Characteristics are:

  - Lack of interest in ISD and thus, a lack of qualified personnel for the implementation of ISD. This problem, in turn, contributes to the situation wherein at any given time a large proportion of ISD team members are in training for their particular responsibilities.

  - Lack of both upper-level and implementation-level support impacts management, coordination with higher command, procurement, and specific tasks and subtasks. Impact results from both ignoring ISD and from the tendency to give ISD problems a lower priority than non-ISD problems.

  - Occasional tendency to assign local personnel to ISD without proper consideration of individual qualifications and background.

Summary. This subsection has discussed the relationships which currently exist between ISD and the various training and training support agencies. It includes discussion of the sources and results of STAN/EVAL resistance to ISD; the association of the ISD team with the various sections of the training squadron; the inadequate production capabilities; and finally, the impact of ISD on an individual's Air Force career. Solution of these problems would enhance the progress of ISD by improving working relationships and conditions within the process.

## SECTION 4

## CONCLUSION

The primary thrust of this study has been the identification and description of problems encountered in the implementation of ISD in flying training. The study itself is intended as the first step in the effort to solve these problems. The following conclusions are submitted in support of this effort.

4.1 SCOPE OF ISD. It is well known that ISD is an extremely time-consuming process. Unfortunately, it is a matter of speculation as to exactly how timeconsuming. Present investigators have tentatively suggested an excess of five years is required, under ideal conditions, for the conversion of the typical flying training programs. This estimate might appear to be too great for a single-seat aircraft program with well known mission requirements; yet, it might also appear to be too little for a program like AWACS with mission requirements as yet undefined and over 20 crewmembers aboard the aircraft. In any case, ISD time requirements always number in the years and in the thousands of labor hours. Consequently, any savings or efficiencies effected as a result of addressing the problems identified in this study can be multiplied many times over. On the other hand, the costs of these problems, while they persist, are presently and continuously multiplying themselves many times over. Thus, the sheer magnitude of ISD programs provides an excellent argument for continuing problem-solving efforts beyond the present step of identification and description.

4.2 STATUS OF ISD. Some of the problems which presently exist in the implementation of ISD are apt to persist for some time in spite of corrective efforts. For example, the preponderance of slide/tape modules represents the bulk of the mediation effort within flying training. In this particular case the persistence will result from a lack of detail in the documentation regarding media selection, current media hardware investments, training received in Air Force ISD schools, and the general direction of AAVS media support functions. Such constraints are typically enduring, though ultimately, not impossible to correct in the interests of a well-balanced program. Other problems, with other constraints, also require longer-term solutions than are expedient.

For example, the acute management deficiency, the impact of which is felt throughout ISD, is only now being corrected. The issue of specific training for ISD managers is receiving a high priority in recent years for the first time in the history of ISD; though the issue itself has been recognized from the earliest days. Due to the persistence of the problem over a long period of time, its impact reaches into every phase and segment of ISD, and will, no doubt, take years rather than months to correct. The placement of management personnel throughout Air Force ISD is only the first step. A great deal of time will also be required to shape the various programs according to the practices and procedures of optimal or improved management.

Similar persistence of impact accrues to the wide variety of organizational structures now in existence. Though the variety has provided benefits to ISD, particularly with regard to allowing progress to continue in spite of local resistance, there are also benefits to be obtained from a more standard organizational structure. Among the latter are better definitions of the authority and responsibilities of ISD teams in relation to other training sections, and, the more efficient regulation and direction of the supporting agencies. Time requirements for implementing a more standardized organizational approach to ISD are also likely to number in years.

Such problems are being recognized and addressed by ISD personnel with increasing frequency as experience levels in the technical and managerial aspects increase. ISD personnel presently have a better understanding of the technical and time requirements of the process than was the case in the past. Consequently, there is a better utilization of both resources and personnel. There is also an emerging acceptance of ISD as a total systems approach rather than a series of steps to be accomplished on some segment or portion of flying training. This acceptance is partially responsible for the fact that ISD teams are beginning to return to the task analysis in order to strengthen it by means of a systematic, rather than a cursory or short-cut approach. Finally, there is an increasing acceptance of the greater responsibilities associated with an expanded role which accrues to ISD. That is, the provision of analytic input to training device and simulator procurement processes, though not a formal step of ISD, promises a better match between training requirements and training device functional capabilities. Similarly, an increasing concern and involvement with continuation training ensures a better orientation of the training system to the operational or advanced training requirements of user communities. Thus, current status of ISD may be characterized as one of increasing awareness and understanding of an expanding set of roles and responsibilities.

4.3 <u>STATE OF ISD</u>. Though ISD progressed haltingly for the first few years, the programs are, on the whole, gaining in both momentum and effectiveness. ISD teams throughout the Air Force have made significant progress at this time and the progress appears to be accelerating. In addition, both ISD technical and management experience are currently available in larger amounts than ever before. Discussions with these personnel warrant the conclusion that the depth of knowledge, thus the level of expertise, in these groups is also greater. Thus, to reiterate a point, the prognosis for ISD is good, particularly while the expert personnel are available to address the problems outlined herein.

# APPENDIX

## DATA COLLECTION METHODS AND INTERVIEW SCHEDULE

The interview technique originally selected was that of the structured interview. However, the range of variability noted in the data resulted in a reliance on a more informal or open-ended procedure. After initial contact was established with ISD personnel, a number of the more fundamental topics likely to impact ISD were covered, regardless of command or location. From this perspective the data collection forms served as functionally useful points of departure for the extensive discussions which followed.

Personnel interviewed included ISD team chiefs, STAN/EVAL personnel, educational specialists (both civilian and military), media production personnel, subject matter experts (SME), and others. The onsite visit to the particular unit interviewed, whether squadron level or major command, terminated with an outbrief of the upper level management personnel.

The initial data collection visits were conducted at Air Staff and at the major command headquarters. These visits were conducted by Dr. Jay Swink, the Project Director of the study. The visit to:

a.  Air Staff (XOOV) was conducted on 21 April 1977. The primary points of contact for this visit were Colonel Ripley, Lieutenant Colonel Black and Captain West.

b.  Headquarters, Tactical Air Command (TAC/DOOS), was conducted on 22 April 1977. Primary point of contact for this visit was Lieutenant Colonel Griffin.

c.  Headquarters, Military Airlift Command (MAC/DOTF), was conducted on 25 April 1977, and the primary point of contact was Major Roy Baker.

d.  Headquarters, Strategic Air Command (SAC/DOTP), was conducted on 26 April 1977, and the primary points of contact for this visit were Major Heinrich and Captain Allen.

e. Headquarters, Aerospace Defense Command (APC/DOXI) was conducted on 28 April 1977. Primary points of contact were Major Komnick and Major Aftosmis.

f. Headquarters, Air Training Command (ATC/DOTC), was conducted on 29 April 1977, and the primary points of contact were Lieutenant Colonel Hess, Major Davis and Captain Muellhoeffer.

At the flight training squadron level the onsite interviews were conducted by both Dr. Jay Swink, the Project Director, and Ralph Miller, the principal investigator for the study. It was determined that two training psychologists were required at the squadron level investigation because, at this level, the intensity of activity surrounding the ISD process is greatest and the number and types of personnel to be interviewed increase with the size, resources and responsibilities of the local ISD program. The squadron level interview schedule was conducted as follows:

a. ATC's 3305th School Squadron at Randolph AFB, 7 and 8 June 1977. Primary points of contact for ISD were Colonel R. P. Knoebel and Captain C. J. Welch. The interviewed representatives from STAN/EVAL were Colonel Mehaffey and Majors Johnson and McGinnies. Representatives of simulator management were Captains Drown and Marshula.

b. MAC's 1550th Aircrew Training and Test Wing, Kirtland AFB, 9 and 10 June 1977. Primary points of contact were at the DOT level, Colonel Ritchie, and at the DOTI level, Lieutenant Colonel Allred.

c. ADCOM's Air Defense Weapons Center, ISD Division, Tyndall AFB, 21 and 22 June 1977. Primary points of contact were at the DOTI level. These contacts were Major Walters and Mr. Sharples, who is working in a civilian capacity as an educational specialist. The local ISD Project Manager is Captain Scott. Also interviewed were Colonel Walton of the Second Fighter Interceptor Training School (or Squadron) and representatives of the local STAN/EVAL section.

d. SAC's 4235 ISD Squadron, Carswell AFB, 23 and 24 June 1977.
Primary points of contact were Lieutenant Colonel Shelton and
Major Hittle. Mr. Jim Phillips, educational advisor, and
Captain Heiderscheit, coordinator of the Program Development
Center, were also interviewed.

e. ATC's 323rd FTW ISD team at Mather AFB, 5 and 6 July 1977.
Points of contact were Captain Medinger, representing DOTCE,
and Mr. Baxter, a civilian specialist from DOTX. Colonel
Walden was interviewed regarding cost and conduct of task
analysis. Mr. Emory Broome, a civilian specialist, repre-
sented training services, and Messrs. Charles Crosby and
Rod Small, both civilian specialists, represented Evaluations
which organizationally approximates STAN/EVAL but provides'
somewhat different functions. Finally, Captain Callaghan
represented STAN/EVAL.

f. SAC's 93rd BMW ISD team at Castle AFB, 7 and 8 July 1977.
Primary points of contact were Major Redding and Captain
Fiedler. Also interviewed were Captain Lambert, representing
OT&E of new simulators, and Captain Clark, representing
STAN/EVAL. Finally, Colonel Haskett was interviewed and
briefed at the conclusion of the visit.

g. TAC's 552nd AWACS training team at Tinker AFB, 19 and 20
July 1977. Primary points of contact were Lieutenant Colonel
Cariveau and Mr. Graham, the civilian educational specialist.
Also interviewed were Captain Gregory, a specialist in edu-
cational psychology, and Major White from STAN/EVAL.

h. MAC's 443rd MAW ISD team at Altus AFB, 21 and 22 July 1977.
Primary points of contact were Mr. Gail Miller, civilian
specialist and Chief of Training at the wing level; and Major
Farmer, also at the wing level. Lieutenant Colonel Owen Lee,
an ISD specialist and Chief of Academics, was extensively
interviewed. Also interviewed were Sergeant Rickey, in
academics; Mr. Stahl, civilian specialist; a representative
from AAVS; and a representative from STAN/EVAL. At the
conclusion, Major Arnold provided an overview and discussion
of learning objectives.

i. The final collection site visit occurred at TAC's 4444th ISD Squadron at Luke AFB, 11 August 1977. Primary points of contact were Lieutenant Colonel Thomas Rush of the 4444th Operational Squadron, and Major William Douglas, operations officer. The representative from STAN/EVAL was Captain Thomas Moore.